EDUC 5555
Assessment & Intervention

Core Standards and Instructional Practice for Tier 1

CLASS #7

Trading Horses

A man bought a horse for $50.

He sold it for $60.

Then he bought the horse for $70.

He sold it again for $80.

What is the financial outcome of these transactions?

(Ignore cost of feed for horse, cost of boarding etc.)

- **Independently solve the problem.**
- **Be ready to justify your solution.**

What did you notice?

- Task to engage students with mathematics at the beginning of class
- Problem was given a title.
- Quiet independent work time was provided.
- Mathematical thinking was shared with a partner or small group.
- Group mathematical thinking shared with the entire group.

Class 7 Objectives

High-Yielding Mathematics Instruction for Tier 1

- Increase understanding of Common Core Content & Practice Standards
  - Historical perspective
  - Research base
- Explore the 10 Instructional Shifts for Student Achievement in Mathematics as they relate to the application of the practice standards

The Standards » Mathematics

http://corestandards.org/the-standards/mathematics

Where did they come from and why are they here?

In the beginning…

- U.S. National Research Council (NRC) conducted a review of math instruction research
- A panel of researchers with expertise in math instruction reviewed the preceding 30 years of math instruction research and summarized findings in

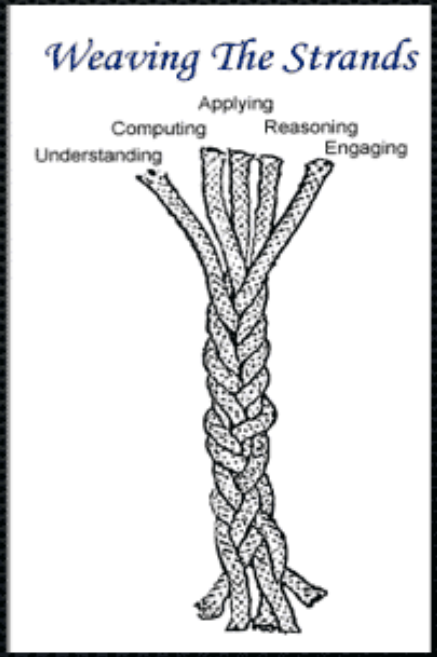
  **Adding it Up: Helping Children Learn Mathematics (2001)*

** One of the texts recommended for this endorsement program*

Adding It Up: 5 Essential Strands

Mathematical Proficiency

1. Understanding
2. Computing
3. Applying
4. Reasoning
5. Engaging



Adding It Up: Helping Children Learn Mathematics The National Academy Press

Strands of Math Proficiency and Sample Skills Related to the Strands

Strand	Sample Skills
1. Conceptual understanding (Understanding)	a) Understanding that a quantity of items matches the same quantity as represented by numerals b) Understanding that some math operations make things bigger and others make things smaller
2. Procedural fluency (Computing)	a) Using accurate and automatic addition, subtraction, multiplication, and division skills b) Using mathematical symbols such as parentheses, plus, and minus signs with accuracy
3. Strategic competence (Applying)	a) Using rules related to the order in which specific problems need to be completed (e.g., PEMDAS) b) Using different ways of representing values such as fractions and decimals
4. Adaptive reasoning (Reasoning)	a) Using mathematical skills for different everyday activities such as cooking and sewing b) Adapting mathematical skills for use in new settings such as stores and workplaces
5. Productive disposition (Engaging)	a) Using learned math skills independently b) Using learned math skills to develop additional skills for solving problems

(Brown-Chidsey, Bronaugh, & McGraw, 2008)

Sample Skills Related to the Strands, Cont'd

- Note: Samples identified in the table are examples and do not represent all math skills
- Key Point identified in *Adding It Up:*
  - All students need to be able to master all of the strands and skills identified in the table to develop proficiency in math

Adding It Up: 5 Essential Strands, Cont'd

- All 5 components or strands are *interdependent*
- All 5 strands are identified as essential for *all* students
- All 5 strands must be included in math instruction at all grade levels
- The 5 strands provide a way to organize the math instruction
- All strands can be matched with specific student instructional skills

Teachers of Mathematics (NCTM)

The NCTM published its Curriculum Focal Points for Prekindergarten Through Grade 8 Mathematics: A Quest for Coherence (2006) as a companion to its comprehensive and influential Principles and Standards (2000).

The Focal Points describes the most important mathematical topics for each grade level and, since the document's release, has been widely used by state mathematics content developers in designing their own standards and curricula. When published in 2006, the Focal Points provided fresh guidance on what students should learn each year, and the ways in which the strands of mathematical learning should connect with one another across the grades.

National Mathematics Advisory Panel (NMAP)

- U.S. DOE appointed a National Mathematics Advisory Panel (NMAP) in 2006
- Panel included researchers with strong expertise in mathematics and mathematics instruction
- Panel charged with reviewing all available research about math instruction and summarizing findings
- Final Report: *Foundations for Success, 2008*

Summary of the National Research Council Report, Based on the National Math Panel Report: Math Proficiency of U.S. Students

- International comparisons
- Low fractions of proficiency on NAEP
- Falling proficiency at higher grades
- Heavy remedial demand upon entry into college
- Achievement gap

Recommendation: Algebra as a gateway rather than the destination…

(K-8 Math model)

(NMAP Report, 2008)

NRC Report: Math Proficiency of U.S. Students

American students achievement in mathematics is mediocre compared to international peers:

- 32% of our students are at or above the "proficient" level in Grade 8, but only 23% are proficient at Grade 12. Consistent with these findings is the vast and growing demand for remedial mathematics education among arriving students in 4-year colleges and community colleges across the nation.
- On the TIMSS (Trends in International Mathematics and Science Study), U.S. students do less well in Grade 8 than grade 4. The performance is still poorer in Grade 12.
- In the PISA (Programme for International Student Assessment), U.S. 15-year-olds ranked 25th among 30 developed nations in math literacy and problem solving.
- Even in elementary school, only 7% of U.S. 4th-graders scored at the advanced level in TIMSS, compared to 38% of 4th-graders in Singapore, a world leader in mathematics achievement

(NMAP Report, 2008)

Basis of the Panel's work

- Review of **16,000** research studies and related documents.
- Public testimony gathered from 110 individuals.
- Review of written commentary from 160 organizations and individuals
- 12 public meetings held around the country
- Analysis of survey results from 743 Algebra I teachers

(NMAP Report, 2008)

NRC Effective Math Instruction Research Findings

- Core Conclusions:
  - All U.S. children must develop math proficiency for successful academic achievement
  - Math skills must be viewed as important for all children to learn
  - Identified 5 Essential Components termed "Strands" of Effective Math Instruction

Small group activity: National Math Advisory Panel Report Fact Sheet

Small Group Discussions:

- Read and discuss NMAP Fact Sheet findings
  - Identify potential current math curricula strengths and weaknesses to share with the group
  - Note any surprises, aha's or questions to share with the group

NMAP Final Report Findings

NMAP Report identified 6 main steps needed to improve math achievement:

1) Pre-K to 8th grade math curriculum should be streamlined to emphasize a narrower set of the most critical skills and topics
2) Implementation of best practice instruction methods and knowledge of how children learn with a focus on the benefits and importance of:
    - Early Intervention
    - Conceptual Understanding
    - Fluency
    - Automaticity
    - Effort

NMAP Final Report Findings, Cont'd

3) **Elementary grade teachers must have strong math skills in order to teach math well** (Yay for you getting your math endorsement!) ☺

4) Math instruction should not be purely 'student-centered' or "teacher centered" but must be an integration of both perspectives based on the findings of research

5) National assessments such as National Assessment of Educational Progress (NAEP) should be strengthened to include emphasis on the most critical math knowledge and skills

6) There is a need for more rigorous research about math instruction and the findings of such research must be used to improve teaching practices

(Brown-Chidsey, Bronaugh, & McGraw, 2008)

Critical Foundations for Algebra

The National Mathematics Advisory Panel report offers recommendations for how we can best prepare elementary and mic dle school students for success in algebra, a gateway to mathematics in high school and beyond.

Mathematics Preparation for Algebra

- Follow a focused, coherent progression of mathematics
- Achieve proficiency with whole numbers, fractions, and aspects of geometry and measurement
- Build deep understanding
- Emphasize fractions and related concepts

Comprehensive Instruction

- Develop conceptual understanding, computational fluency, and problem-solving skills
- Achieve automaticity in computation
- Provide adequate practice
- Encourage effort and persistence

Mastery Framework

- Set benchmarks for key skills
- Use formative assessments
- Provide explicit instruction for struggling students
- Offer acceleration and enrichment for gifted students

Grade-Level Benchmarks

Skills necessary to be Successful at this Level

PRE-K	
K	
1ST	
2ND	
3RD	Add and subtract whole numbers
4TH	Identify, represent, and compare fractions and decimals
5TH	Multiply and divide whole numbers
	Compare, add, and subtract fractions and decimals
	Solve problems with perimeter and area
6TH	Multiply and divide fractions and decimals
	Use all operations on integers
	Analyze properties and measures with 2- and 3-D shapes
7TH	Use all operations on positive and negative fractions
	Solve problems with percent, ratio, rate, and proportion
8TH	Relate similar triangles with slope of a line

DOING WHAT WORKS
U.S. Department of Education

* For full report, including text for the benchmarks, please see: www.ed.gov/about/bdscomm/list/mathpanel/report/final-report.pdf

So here's an algorithm:

NRC + NMAP + NCTM = CCSS-M
Common Core State Standards in Mathematics

Note: The Common Core initiative is a STATE initiative, not federal, and was organized by the the Council of Chief State School Officers (CCSSO) and the National Governors Association Center for Best Practices (NGA Center) and informed by teachers, administrators, parents, and research.

A summary of the CCSS-M (K-8)

The K-5 standards provide students with a solid foundation in whole numbers, addition, subtraction, multiplication, division, fractions and decimals—which help young students build the foundation to apply more demanding math concepts and procedures successfully, and move into applications. They also provide detailed guidance to teachers on how to navigate their way through knotty topics such as fractions, negative numbers, and geometry, and do so by maintaining a continuous progression from grade to grade.

Having built a strong foundation in K-5, students can move to more complex work in geometry, algebra and probability and statistics in the middle grades (6-8) to gain a rich preparation for high school mathematics.

A summary of the CCSS-M (9-12)

The high school standards call on students to practice applying mathematical ways of thinking to real world issues and challenges; they prepare students to think and reason mathematically across the major strands of mathematics, including number, algebra, geometry, probability and statistics.

Note that the CCSS promote rigor not simply by including advanced mathematical content, but by requiring a deep understanding of the content at each grade level, and providing sufficient focus to make that possible.

A summary of the CCSS-M (9-12 continued)

The CCSS in mathematics lay out a vision for what all students need to master to be ready for credit-bearing college mathematics courses without remediation.

Some of the high school standards are designated by a (+), indicating that they are *above* the college and career requirement but necessary for students to take advanced mathematics courses in high school such as calculus, advanced statistics, or discrete mathematics, and to be prepared for Science, Technology, Engineering, and Mathematics (STEM) coursework in college.

CCSS Domains K-12

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade	7th Grade	8th Grade	Secondary I, II, and III
Counting & Cardinality									
Operations & Algebraic Thinking									
Numbers & Operations in Base 10									
Measurement & Data									
Geometry									
				Numbers & Operations - Fractions					
						Ratios & Proportional Relationships			
						The Number System			
						Expressions & Equations			
						Statistics & Probability			
								Functions	
									Number & Quantity
									Algebra
									Modeling

So that's the Content Standards… what about the Practice Standards?

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education.

The first of these are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections.

Practice Standards (con't)

The second are the strands of mathematical proficiency specified in the National Research Council's report *Adding It Up*: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately), and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy).

Common Core Practice Standards

Overarching habits of mind of a productive mathematical thinker

1. Make sense of problems and persevere in solving them
6. Attend to precision

Reasoning and explaining

2. Reason abstractly and quantitatively
3. Construct viable arguments and critique the reasoning of others

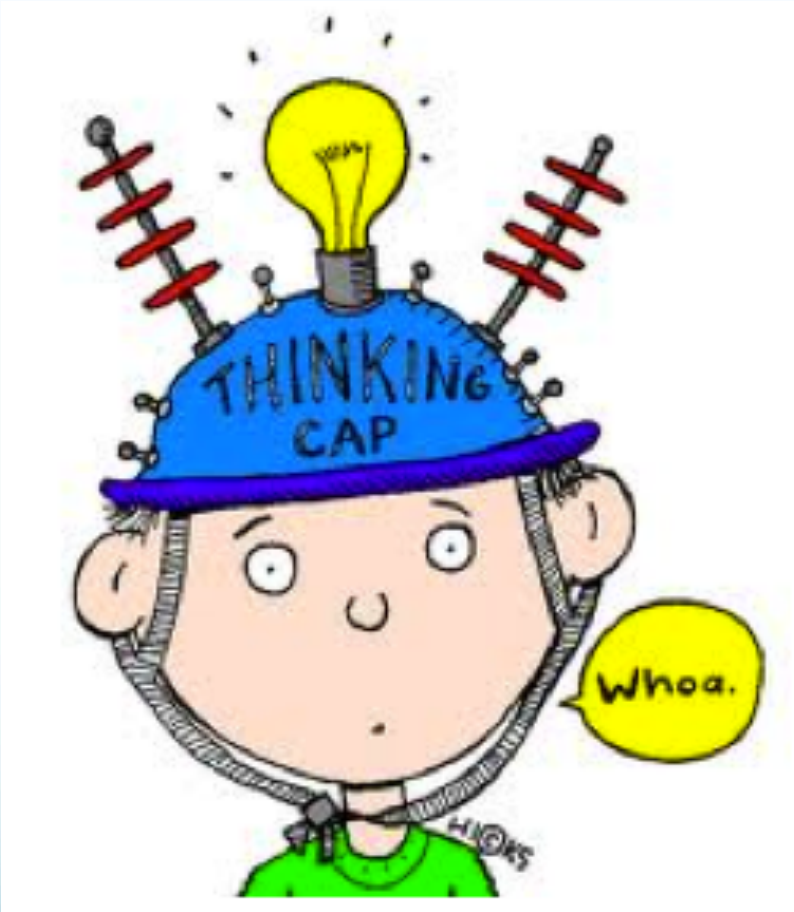
Modeling and using tools

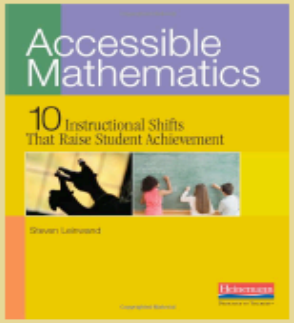
4. Model with mathematics
5. Use appropriate tools strategically

Seeing structure and generalizing

7. Look for and make use of structure
8. Look for and express regularity in repeated reasoning

Break time





Accessible Mathematics: 10 Instructional Shifts That Raise Student Achievement

By Steven Leinwand (Heinemann, 2009)

10 Instructional Shifts Activity

- Count off 1-10 to create 10 small groups (partners?)
- Each group has **20 minutes** to put together a class presentation of their shift
- Groups should use the summary of their shift in the "Main Idea" document to inform their presentation
- Groups may use ppt, poster paper, or whatever resources they have at their disposal to teach the shift
- Groups should be encouraged to MODEL the shift using a math task (much like we did at the beginning of class tonight)
- Come up with a creative way for teachers to remember that particular shift
- Plan for a **5-10 minute presentation**. Do not go over 10 minutes, please.

Class Presentations

(60-100 minutes)

Implementing the Common Core (both the content and the practice standards) and the 10 instructional shifts introduced tonight, while seemingly straightforward, actually entails a significant change for many teachers and for our students.
We will need to convince our students and our teaching peers to engage in new and powerful mathematical behaviors.

Furthermore, professional collaboration is a necessity. Teachers need to discuss the ten instructional shifts as well as what is and what is not working for their students. If we want to make sure that more students master more mathematics, we cannot continue to do what we've always done.

We already have many of the answers to this challenge in the Common Core State Standards and the 10 Instructional Shifts.

Next steps for educators: Institutionalize these practices throughout classes so that mathematics will be taught better and students will learn more.